MOLT OF JUVENILE WHITE-EYED VIREOS

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The extent of the first prebasic (postjuvenal) molt in White-eyed Vireos (*Vireo griseus*) has been a subject of considerable disagreement among ornithologists. Stone (1896) evidently initiated the controversy, stating, "A young bird in first molt is renewing the tail. . . ." Soon Dwight (1900) concluded that young birds undergo a complete first prebasic molt in the northeastern United States, yet admitted "I am not sure this occurs in all specimens." In contrast, another worker in the northeast, Forbush (1929), flatly maintained that the molt involves only the body plumage and the coverts of the wing and tail, and Bent (1950) was "inclined to think that Forbush is probably right, for I can find no birds renewing wing or tail feathers at the postjuvenal molt in a considerable series that I have examined."

Mengel (1965), however, discussing Kentucky-taken specimens, reported that "Many young birds retain considerable juvenile plumage into September, and both adults and immatures in the series show signs of the complete molt mentioned for the species by Dwight. . . ."

Together these contradictory statements suggest the possibility of individual and/or geographic variation in the first prebasic molt of the species. The present paper aims to demonstrate, first, that young White-eyed Vireos in southern Illinois typically replace most and probably all major flight feathers during juvenile life, and second, that certain specimens or populations in the middlewestern prairie region possibly retain some or all juvenal flight feathers until the second prebasic (first postnuptial) molt.

SPECIMENS

Critical specimens undergoing the first prebasic molt are described as follows (each possessed the juvenile traits of the species—skull "windows," and either brown or gray irises—and all stemmed from Jackson and Union Counties, Illinois; my field catalog numbers appear in parentheses):

Early Stages of Molt

1. 12 August 1971 (2339). General body molt. No sheathed or missing remiges, rectrices or greater upper and lower wing and tail coverts.
2. 8 August 1966 (2187). Molting plumage includes primary nos. 5 and 6, secondary no. 8, all greater upper secondary coverts; carpal remex; middle upper primary coverts; middle upper secondary coverts; upper and under tail coverts, and some feathers in all body tracts.

Late Stages of Molt

3. 26 August 1971 (2337). Molting plumage includes primary nos. 5, 6 and 7, secondary nos. 8 and 9, all rectrices (entire tail is represented by sheaths measuring about 10

mm), upper greater coverts associated with the above-named primaries, all greater upper secondary coverts (almost fully grown in), upper and under tail coverts, and some feathers in all body tracts.

4. 13 September 1970 (2336). Molting plumage includes primary nos. 8, 9, and 10, secondary no. 7, all rectrices (a sheathed "bob" tail measuring 39 mm), and some feathers of chin, throat, breast, flanks and rump.
5. 27 August 1971 (2338). Molting plumage includes primary nos. 7, 8, 9, and 10, secondary no. 2, all rectrices (a sheathed tail measuring 44.5 mm), and a few feathers of neck, crown, chest, flanks, plus the greater under wing coverts.

The lesser wing coverts of most of these birds show signs of molt.

From a consideration of this series as a whole, it appears that the first prebasic molt of the southern Illinois population combines: a) descendant loss and replacement of the primaries with each greater upper primary covert being renewed in concert with the primary existing proximal to it; b) complicated but probably sequential renewal of the secondaries (see Stresemann and Stresemann, 1966, for a general discussion of the complex molting patterns of secondaries); c) synchronous or nearly synchronous loss and replacement of the greater upper secondary coverts (a typical sequence in songbirds); d) synchronous or nearly synchronous loss and replacement of the rectrices (a relatively rare phenomenon in songbirds; described in *Cassidix mexicanus* by Selander, 1958, and known in various other passerines: typical of small owls, as shown by Mayr and Mayr, 1954, and Ligon, 1968); e) gradual renewal of the body plumage and of the minor coverts of wing and tail (a typical songbird sequence).

Doubt nevertheless must linger as to whether all remiges are renewed. None of my specimens exhibits a molt stage involving replacement of primary nos. 1, 2, 3, and 4, or secondary nos. 1, 3, 4, 5, and 6. However, the birds with molting middle and outer primaries exhibit what appear to be fresh inner primaries and corresponding fresh greater upper primary coverts, while the same birds also exhibit apparently fresh inner and middle secondaries.

VARIATION IN THE MOLT

Table 1 compares the minimum and maximum lengths of the closed tail, folded wing (more or less flattened) and individual primaries of juveniles and breeding birds. Measurements of the primaries were obtained from specimens prepared with one wing fully extended. A millimeter rule was used, placing its tip at the inserted feather base on the proximal side of the calamus of all the primaries except the innermost, which was measured from the distal side of the feather.

Only a small sample was available to me but I believe it is sufficient to indicate that juveniles tend to possess markedly smaller primaries than the breeding birds. This tendency particularly is striking in respect to primary

TABLE 1

MINIMUM AND MAXIMUM LENGTHS (MM) OF WING, PRIMARIES, AND TAIL IN BREEDING ADULT AND JUVENILE *VIREO GRISEUS* FROM SOUTHERN ILLINOIS

Length	Adult		Juvenile	
	♂*	♀	♂	♀
	N = 6	N = 6	N = 2	N = 3
Wing	59–64	58–60	59	57–59
Primary 1	42–44	42–43	41–43	39–41
2	43–45	44–45	42–43	42–43
3	44–46	43–45	43–46	43–45
4	45–47	45–46	43–47	43–45
5	48–50	47–48	46–48	46–47
6	49–51	48–50	47–48	46–48
7	47–50	47–48	45–46	44–46
8	47–49	47–48	43–44	42–43
9	39–40	38–40	37	35–37
10	16–18	15–18	16–20	15–20
Tail	46–49	46–48	44–45	44–49

* One specimen with unusually small measurements is not included; see text.

no. 8, which ranges in length from 42 mm to 44 mm in juveniles and from 47 to 49 mm in the other age groups. Accordingly, the specimen that I have set off by itself at the bottom of Table 1 (W.G.G. 2214) merits special comment.

Its measurements overall correspond to those of a small female in unworn juvenal plumage. This bird, however, is a spring male, the flight feathers of which are somewhat more worn than are those of my other spring males. Collected as it sang one mile north of Cobden, Union County, on 12 May 1968 (skull fully ossified; iris, white; testes: L, 4 × 4 mm; R, destroyed by shot), it proved to have not only a small wing and short tail but narrow sharp-pointed middle rectrices, as is characteristic of juveniles. Moreover, the bird is undergoing molt of the throat and breast, although the rest of the body plumage appears adult and no prealternate (prenuptial) molt seems to have been recorded in White-eyed Vireos. This bird possibly was an aberrant individual. But because it combines a series of juvenile traits with what can be interpreted as evidence either of delayed elements in the first prebasic body molt, or of a prealternate molt, the specimen may point either to molt variation in our southern Illinois birds, or to an undescribed molt sequence in birds that breed elsewhere (northward?) in the middlewestern prairie region.

WING LOAD IN JUVENILES

White-eyed Vireos in southern Illinois exhibit one striking variation in wing plumage that, though of theoretical significance to the subject of this paper, has not yet been mentioned directly: that is, the wide difference in the overall size of the spread wing of the juveniles. The total surface area of the complete spread adult wing (as traced on paper and measured with a planimeter, after the manner of Poole, 1938) ranges from about 60 cm^2 (worn) to 65 cm^2 (fresh). Some fresh juvenile wings equal and a few even surpass the lower figure, but the remainder fall considerably below 50 cm^2, with one specimen measuring only 42.1 cm^2. The small-winged examples weigh approximately as much as the longest-winged ones (11.2 g to 12.7 g) and thus wing load in them is comparatively unfavorable. For example, in a juvenile with a total wing surface area of 42.1 cm^2 and weighing 11.2 g, wing load is over 0.52 lbs/ft^2 ($= 3.7$ cm^2/g), whereas it is only about 0.34 lbs/ft^2 ($= 5.6$ cm^2/g) in a juvenile with a total wing surface area of 63 cm^2 and weighing 11.2 g. This suggests that perhaps the first prebasic wing molt may be related in part to the desirability of equipping young birds with an adult-sized wing prior to migration.

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